VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI-590 018, KARNATAKA

Project Report on

"FABRICATION OF DRY AND WET WASTE SEGREGATION SYSTEM"

Submitted to Visvesvaraya technological university in the partial fulfillment of requirement for the award of

Bachelor of Engineering
In
MECHANICAL ENGINEERING

Project Associates

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2021-2022

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(Affiliated to Visvesvaraya Technology University, Belagavi)

2021-2022

CERTIFICATE

This is certify that the project entitled "**FABRICATION OF DRY AND WET WASTE SEGREGATION SYSTEM**" has been successfully carried out by **VISHWANATH S U [2SR17ME039], BALAJI K L [2SR17ME005], SAMEER A F [2SR18ME415], KARTHICK S M [2SR18ME405],** a bonafide students of **Sri Taralabalu Jagadguru Institute of Technology** in the partial fulfillment for the award of Bachelor of Engineering in **Mechanical Engineering** of the **Visvesvaraya Technological University, Belagavi,** during the year 2021-2022. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it certifies the academic requirement in respect of project work prescribed for the Bachelor of Engineering degree.

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Name of the Examiner   **Signature with Date**

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2) _____   _____

DECLARATION

We **VISHWANATH S U [2SR17ME039], BALAJI K L [2SR17ME005], SAMEER A F [2SR18ME415], KARTHICK S M [2SR18ME405],** student of 8th semester BE in **Mechanical Engineering, S T J Institute of Technology**, Ranebennur, hereby declare that the project work entitled **"FABRICATION OF DRY AND WET WASTE SEGREGATION SYSTEM"** submitted to the **Visvesvaraya Technological University** during the academic year 2021-22, is a record of an original work done by us under the guidance of **Mr. Rajesh K** Associate Professor Department of mechanical Engineering. This project work is submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Engineering in Mechanical Engineering. The result embodied in this they have not been submitted to any other university institute for the award of any degree.

Date : 29/06/2022 **Project Associates**

Place: Ranebennur **VISHWANATH S U** **[2SR17ME039]**

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ACKNOWLEDGEMENT

We take it as a privilege to express through this page of the report a few words of cordial gratitude and respect to all those who guided and inspired us at every step towards the completion of this project.

I here acknowledge my sincere and heartfelt gratitude to our respected principal **Dr. Shivakumara. B**, for providing a healthy environment in the college, which helped in concentrating on the task.

With great pleasure, I would like to express my deep sense of gratitude to our project guide **Rajesh K** Associate Professor, **Prasanna P Kulkarni** Assistant Professor and **Dr. J O Kiran**, Associate professor Head of the Mechanical Engineering Department, Sri Taralabalu Jagadguru Institute of Technology, Ranebennur for his valuable support, constant encouragement and kind help at different stages for the execution of this project work.

I would also like to thank all staff members of STJIT Ranebennur and my friends for their help and co-operation throughout the project work. And for all those who have helped directly or indirectly in this endeavour. Last but not the least, our heartfelt thanks to our parents who encouraged and had given moral support to us throughout the course of our study.

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ABSTRACT

Dry and Wet waste segregation system is developed to overcome the challenges, barriers and to provide an opportunity for improvements in waste management and segregation system. The Automatic waste management and segregation system use the concept of IoT, where the proposed system is placed all over the cities, with an embedded system to segregate and monitor the level of the bin. The status of bins is sent to concerned authorities to evacuate the bins and the locations of bins are traced via the internet. This system reduces human intervention, interaction and also reduces the consumption of time and cost.

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CHAPTER 01

INTRODUCTION

In the current situation, World is facing various challenges in the environment by the waste generated such as improper waste collection, treatment, transport, disposal. The most difficult challenge is from its inception to its disposal. Due to the increasing urban population, our country cannot survive the current system which results in environmental and public health pollution.

Waste can be solid, liquid and gas each type of waste will have different methods of disposal. Waste will be a threat to human health. Proper management of waste is necessary and important to have a healthy lifestyle. An unhygienic environment will be created if flooding of the dustbins happens every day. Waste segregation i.e., separation of dry and wet waste is also important. Segregation of waste helps in the reduction of the amount of waste that gets landfilled and also reduces air and water pollution. If we segregate the waste, it is easy to dispose of compared to mixed waste.

This application helps in managing and segregating waste. Dustbins are placed in the entire city; it is delivered with minimum cost embedded method to assist in tracking of the garbage bins. Once the bin is filled and reached its maximum level an SMS text is sent to the municipal corporation. Then instant action will be taken by the respective authorities once the status of the bin will be notified through the Internet. This system which is proposed is developed by using ultrasonic sensors, moisture sensor, GSM Module, Arduino UNO, servo motor.

1.1 OBJECTIVE

- Waste segregation refers to the separation of dry and wet garbage, which covers the way for other concepts of waste management like composting, recycling and incineration.
- To reduce waste from landfills and prevent land, water and air pollution.
- Provide a notification of the garbage level to the municipality.

CHAPTER 02

LITERATURE REVIEW

Padmakshi Venkateshwara Rao et.al., [1] (2020) introduces the "IoT based Waste Management for Smart Cities" to overcome the challenges in the environment such as inadequate waste collection, treatment, disposal. Due to flooding of the dustbin causes unhygienic conditions are created, the dustbin is placed in the entire city; it is delivered with minimum cost embedded method to assist in tracking of the garbage, therefore the "Blynk app" is used to get the immediate SMS as early as garbage bin reaches its peak level. Therefore, instant --action will be taken by the alarmed authorities once the status of a bin is notified through the internet. Ultrasonic sensor, node MCU, blynk app, a servo motor is used to develop the proposed system.

Nikolaos Baras et al., [2] (2020) introduces "A cloud-based smart recycling bin for in-house waste classification" urban waste increases as long as modern lifestyle increases. Recycling is the best way to create a sustainable environment and also it needs the segregation of waste materials which is a tedious time-consuming task. It is the minimal cost and effective smart recycling bin that uses the power of the cloud in order with waste classification in personal in-house usage. A centralized Information System collects measurements in smart dustbins, the waste in each bin can be classified using Artificial Intelligence and also neural networks. And it is capable of classifying different types of waste with an accuracy of 93.4%.

Shashank Shetty et al.,[3] (2020) This introduces the SAF-Sutra: "A Prototype of Remote Smart waste segregation and garbage level monitoring system", which can remotely monitor and is built at a very minimal cost. The design of the presented system considers the portability and ease of assembly of components as the essential factors during implementations. The demonstration shows the implemented system; its interaction with the user using the mobile along with the web application.

Dr. Elena v. Rosca et al., **[4]** Introduces the Smart System and the Internet of Things (IoT) for waste management to provide an efficient and effective manner for waste disposal, improving the city's waste management. The proposed system is drawn and

makeup a prototype of a solar powered, compact smart garbage bin whose monitoring is done with server-side applications. The smart garbage bin is capable of monitoring internal garbage levels, compact them, and also free 25% of the space with each compactness. The bin detects and monitors the total weight and is capable of sending all the information to a secure server-side application.

Rania Rizki Arinta et al., **[5]** (2020) introduces the "Improves smart waste management to preserve tourist's attractions Yogyakarta in IoT environment", the main agenda is to make waste recycled, if it is not recycled, it will make the decomposition process more tedious. Therefore, the dustbin is integrated with the smartphone to find out information about the capacity of the garbage by using the ultrasonic sensor. The wi-fi module combined with the dustbin allows the sensor to send the data through the wi-fi module via smartphone.

Chethan Kaushal et al., **[6]** (2020) introduce the Architecture for garbage monitoring systems using integrated technology, proposed the novel architecture of waste management that utilizes the concept of IoT and digital image processing, the architecture acts as a surveillance system to monitor the over the flow of the garbage and delivers the message to the concerned authorities to take the necessary and instant action.

2.1 PROBLEM STATEMENT

From the literature review the following points were observed

- Urban India generates 62 million tons of municipal solid waste each year. This has about 43 million tones (70%) is collected and 11.9 million tones (20%) is treated. About 31 million tones (50%) is dumped in landfill sites.
- It required a lot of manpower to segregate the waste manually after collection, because of that more lives are in hazards surrounding.
- Efficiency of waste segregation is less.
- Frequently, in our city we see that the garbage bins or dustbins placed at public places or in private building are overloaded. It creates unhygienic conditions for people as well as ugliness to that place leaving foul smell.

The problem related to the segregation of dry and wet waste is the challenging work, also it consumes lot of man power and investment. If municipalities implement the waste segregation it can generate revenue. Hence a device is fabricated with help of ARDUINO microcontroller to segregate the wet and dry waste automatically which will save the man power as well as investment.

CHAPTER 03

METHODOLOGY

The Automatic Waste Segregator System is driven by the Microcontroller Arduino UNO. All the components that are connected to Arduino UNO are programmed using the Arduino IDE. The program is written in Embedded C language and it reads the input/output pins of the components. The servo motors are present to deflect the wet and dry waste into the specific bins. The dry waste has paper and plastic which are differentiated using the moisture sensor. The wet waste is examined with the help of Moisture sensor. The measure of the dustbin level is calculated by the Ultrasonic sensor connected at the edge of the dustbin. When the dustbin is full, a message- BIN IS FULL is sent to the cleaning authorities. The message is sent using the GSM module that provides the communication between the bin and the authority. The location of the bin can also be sent. The location is known with the usage of GPS module that is connected to the system.
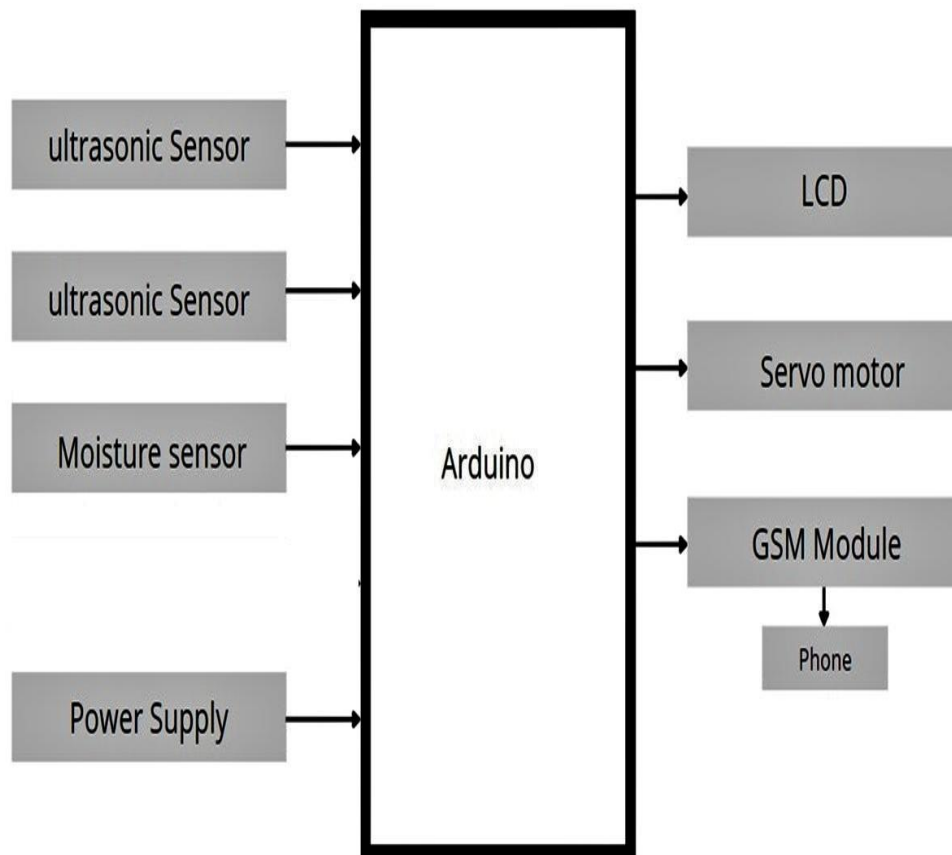
3.1 BLOCK DIAGRAM

Fig 3.1: Block Diagram.

CHAPTER 04

HARDWARE COMPONENTS

4.1 MECHANICAL COMPONENTS

4.1.1 Frame:

A frame is often a structural system that supports other components of a physical construction. Mild steel hollow tubes are widely used to ensure rigidity and also as comparatively less in weight. It is joined with a welding process for optimal result and strength.

Fig 4.1: Frame with Bins.

Specifications:

- Metal Base Plate dimension: 340 * 190 mm. (length*Width)
- Metal Frame rod dimension: 710 mm. (H)
- Container bin capacity: 2kg.
- Container bin Height: 190 mm.
- Container bin diameter: 100mm.

4.2 ELECTRICAL COMPONENTS
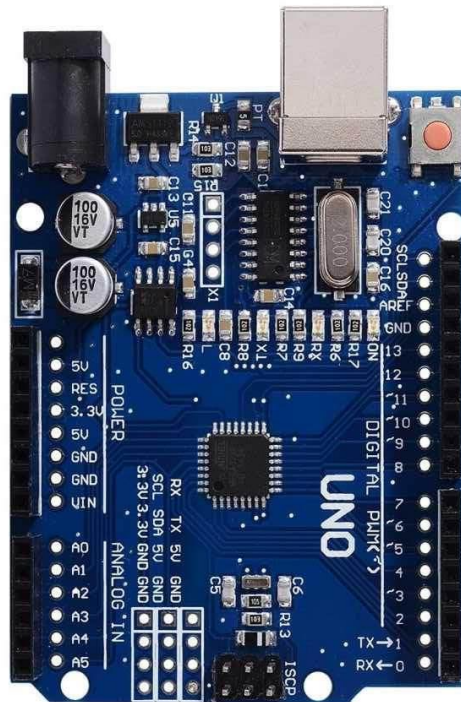
4.2.1 Arduino Uno:

Fig 4.2: Arduino UNO.

It is an open-source electronics platform dependent on simple to interface hardware and execute programming. The assortment of chip and controllers is done with the help of Arduino board structures. The Arduino boards are equipped with 14 digital pins for input or output, and 6 analog pins for input that are used to interface different circuits. The customization of microcontrollers is done by utilizing Embedded C and C++ programming codes. Arduino microcontroller gives an Integrated Development Environment (IDE) that supports different programming languages. Current Arduino boards are programmed by means of Universal Serial Bus (USB).

Specifications:

- Operating Voltage: 5V

- Input Voltage: 7-20V

- DC current per I/O pin: 20 mA

- Flash Memory: 32 KB

- Clock Frequency: 16 MHz.

- No. of digital pins: 14
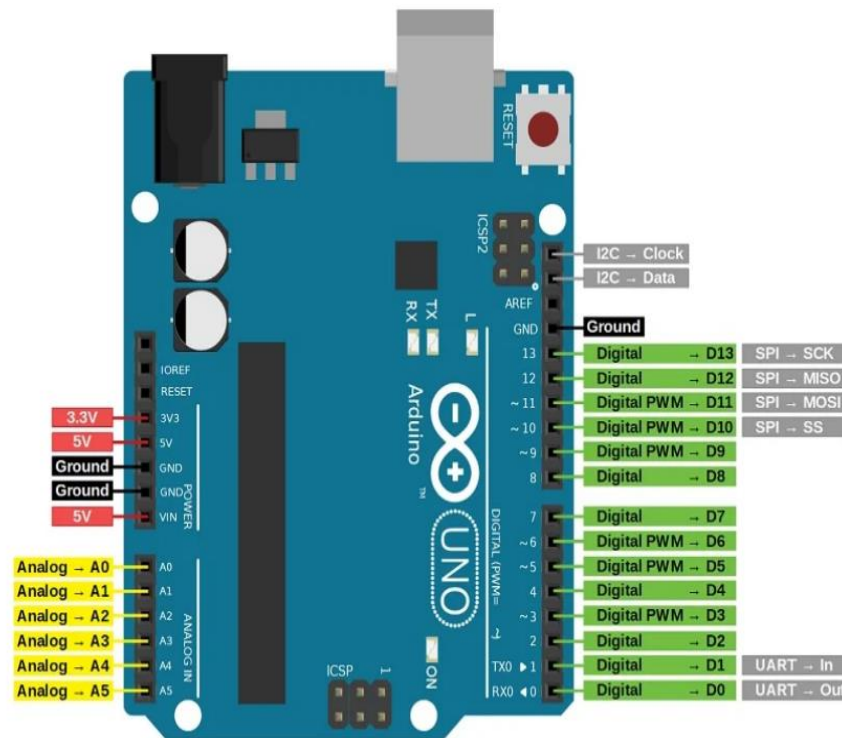
- No. of analog pins: 6

General Pin Functions:

Fig 4.3: General Pin Functions.

- **Vin**: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

- **5V**: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

- **3.3V**: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

- **GND**: This pin of the board is used to ground the Arduino board.

- **Reset**: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

- **Analog Pins**: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

- **Digital Pins**: The pins 0 to 13 are used as a digital input or output for the Arduino board.

- **Serial Pins**: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 are used to transmit and receive the data resp.

- **External Interrupt Pins**: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.
- **PWM Pins**: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.
- **LED Pin**: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

4.2.2 Ultrasonic Sensor:

Fig 4.4: Ultrasonic Sensor.

Ultrasonic sensor is used to detect the waste on the platform. In short it is used to detect the presence of waste by measuring frequency and listening for that sound wave to bounce back. The range distance of ultrasonic sensor is between 0-10 cm. In short, the Ultrasonic sensor is used to notify Moisture sensor that there is a waste present and then the moisture sensor will start or will be triggered according to the Ultrasonic sensor.
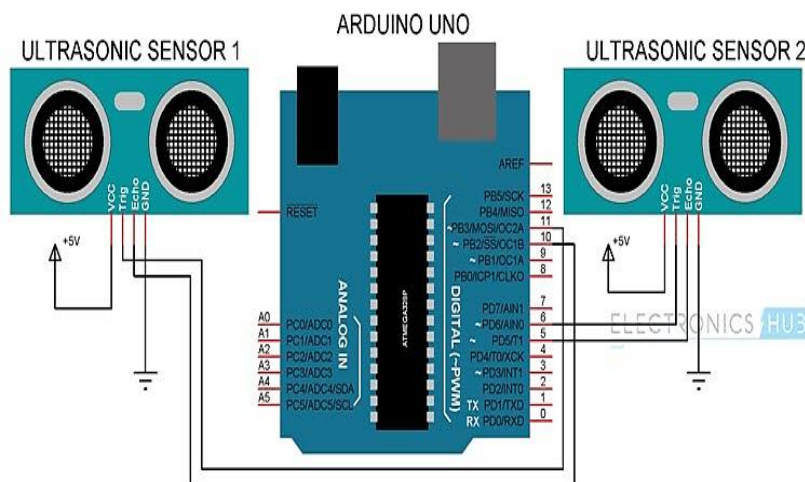

Fig 4.5: Connection from Arduino to Ultrasonic Sensor.

Specifications:

- The sensing range lies between 10 cm to 100 cm.

- The response time is between 50 milliseconds to 200 milliseconds.

- It operates within the voltage range of 20 VDC to 30 VDC.

- Measuring Angle 15 Degree.

- Preciseness is ±5%.

- The frequency of the ultrasound wave is 120 kHz.

- The ultrasonic sensor weight nearly 150 grams.

- Ambient temperature is -25^{0}C to +70^{0}C.

- The target dimensions to measure maximum distance is 5 cm × 3 cm.

4.2.3 Moisture Sensor:
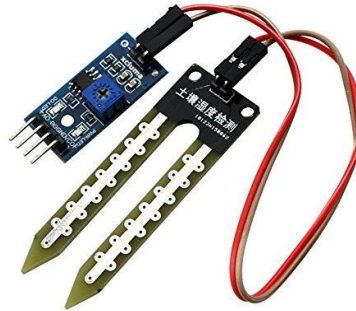
Fig 4.6: Moisture Sensor

The moisture sensor has been used to detect the type of waste being placed on it. Here the sensor classifies the waste into dry and wet based on the moisture content on it.; if the moisture content is above a pre-set threshold value, then the waste is declared as wet waste else it is declared as dry waste.

Fig 4.7: Connection from Arduino to Moisture Sensor.

Specifications:

- Operating Voltage: 3.3V to 5V DC.

- Operating Current: 15mA.

- Output Digital - 0V to 5V, Adjustable trigger level from pre-set.

- Output Analog - 0V to 5V based on infrared radiation from fire flame falling on the sensor.
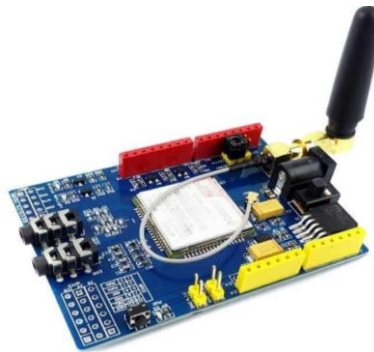
- LEDs indicating output and power.

4.2.4 GSM Module:

Fig 4.8: GSM Module.

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. GSM Modem comes in interfaces like USB, and Serial. GSM Modem is however the main difference is that GSM Modem is wireless, while dial-up modem is wired (telephone previously). GSM is used here to interface with microcontroller and microcontroller command to the GSM modem with AT command set implemented in our program.
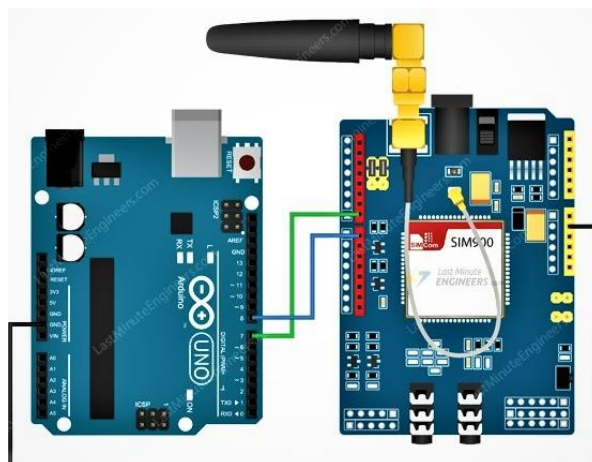

Fig 4.9: Connection from Arduino to GSM Module.

Specifications:

- Single supply voltage: 3.4V – 4.5V.

- Power saving mode: Typical power consumption in SLEEP mode is 1.5mA.

- Frequency bands: SIM900A Dual-band: EGSM900, DCS1800. The SIM900A can search the two frequency bands automatically. The frequency bands also can be set by AT command.

- Operating Temperature: -30ºC to +80ºC.

- Storage Temperature: -5ºC to +90ºC.

- DATA GPRS: download transfer max is 85.6KBps, Upload transfer max 42.8KBps.

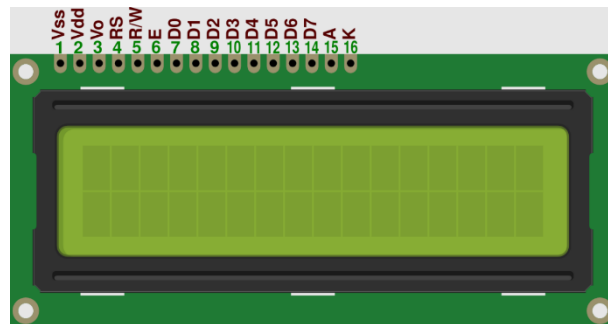- Supports CSD, USSD, SMS, FAX.

- Supports single SIM card.

4.2.5 LCD Display:

Fig 4.10: LCD Display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.
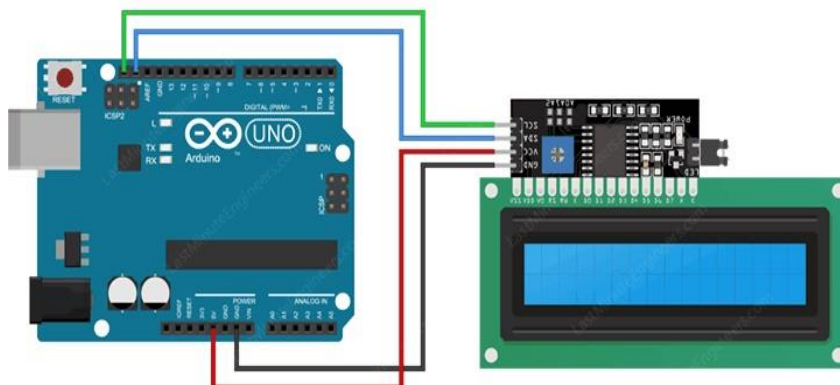

Fig 4.11: Connection from Arduino to LCD Display.

Specifications:

- The operating voltage of this display ranges from 4.7V to 5.3V.
- The display bezel is 72 x 25mm.
- The operating current is 1mA without a backlight.
- LED colour for backlight is blue.
- Number of columns – 16.
- Number of rows – 2.
- Number of LCD pins – 16.
- Characters – 32.
- It works in 4-bit and 8-bit modes.
- Pixel box of each character is 5×8 pixel.

4.2.6 Servo Motor:

Fig 4.12: Servo Motor.

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism.
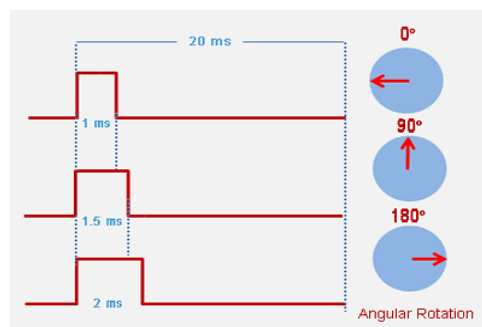

Fig 4.13: Servo Motor Position.

Servo motor can be rotated from 0 to 180 degrees, but it can go up to 210 degrees, depending on the manufacturing. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. The pulse of 1 ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2 ms pulse can rotate it to 180 degree.
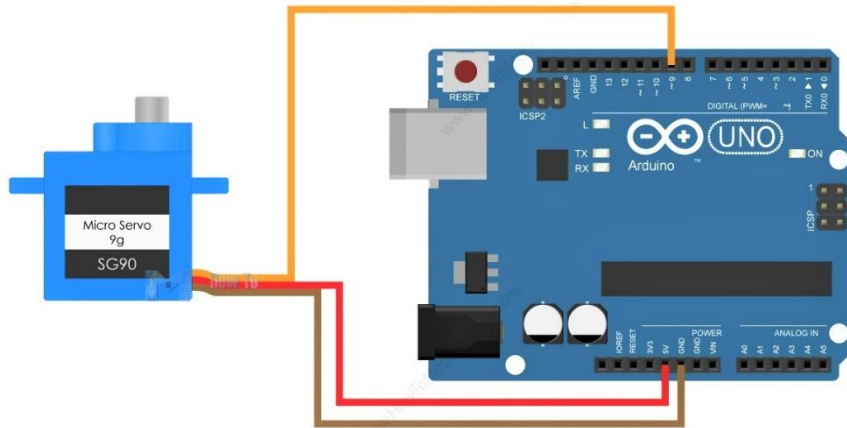

Fig 4.14: Connection from Arduino to Servo Motor.

Specifications:

- Model: SG90

- Weight (gm): 09

- Operating voltages: 3.0-7.2 v

- Operating speed @ 4.8v: 0.10sec/60°

- Shall Torque @ 4.8v: 1.2 kg-cm

- Shall Torque @ 6.6v: 1.6 kg-cm

- Operating Temperature ($^\circ$C): -30 to 60

- Dead Brand Width: 7µs

- Gear Type: Glass Fibre

- Rotational Degree: 180º

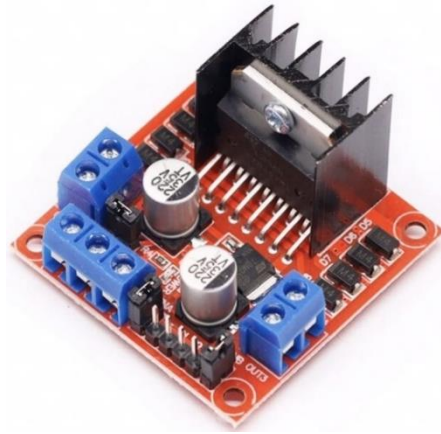- Dimensions: 6*6*4 cm

4.2.7 Motor Drive Module:

Fig 4.15: Motor Drive Module.

This dual bidirectional motor driver is based on the very popular L298 Dual H-Bridge Motor Driver IC. This module will allow you to easily and independently control two motors of up to 2A each in both directions.

Specifications:

- Driver: L298.
- Driver power supply: +5V~+46V.
- Logic power output VSS: +5~+7V (internal supply +5V).
- Logic current: 0~36mA.
- Controlling level: Low -0.3V~1.5V, high: 2.3V~Vss.
- Dimension: 2.7 * 4.5 * 4.5 cm.
- Driver weight: 48g.

4.2.8 DC Motor:

Fig 4.16: DC Motor.

DC motor converts electrical energy in the form of Direct Current into mechanical energy in the form of rotational motion of the motor shaft. The DC motor speed can be controlled by applying varying DC voltage; whereas the direction of rotation of the motor

can be changed by reversing the direction of current through it. For applying varying voltage, we can make use of PWM technique. For reversing the current, we can make use of H-Bridge circuit or motor driver ICs that employ the H-Bridge technique.
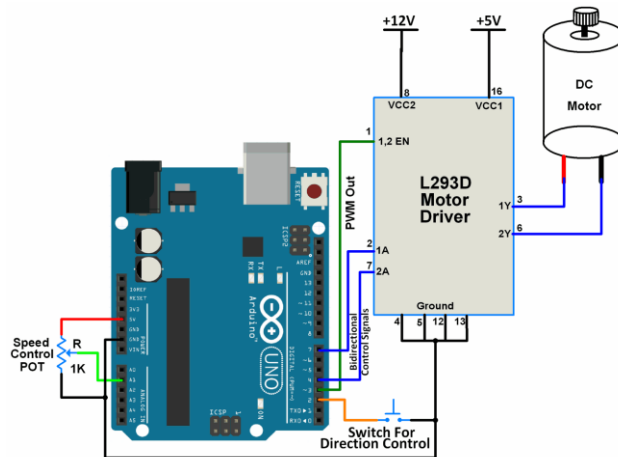

Fig 4.17: Connection from Arduino to DC Motor.

Specifications:

- 30Rpm 12V Dc Motors with Gearbox
- 6mm Shaft Diameter with Internal Hole
- 125Gm Weight
- Stall Torque = 1.5Kgcm Torque

4.2.9 Battery:

Fig 4.18: Battery.

An electrical battery is a source of electric power consisting of one or more electromechanical with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and negative terminal is the anode. The terminal marked negative is the sources of electrons that will flow through an external

electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.
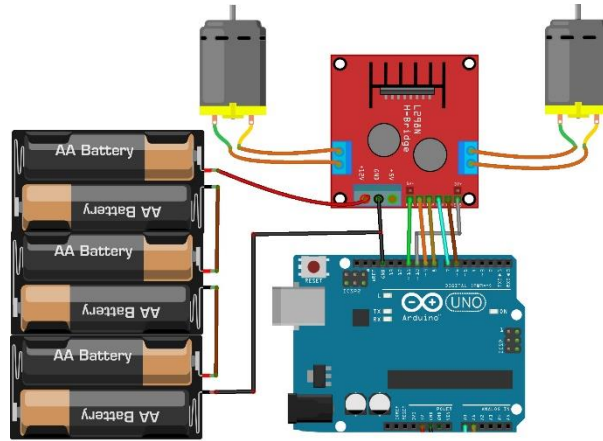

Fig 4.19: Connection from Battery to Arduino.

Specifications:

- Length :150mm.
- Width: 65mm.
- Height: 90mm.
- Weight: 2.54kg.
- Voltage:12v.
- Capacity 7Ah.
- Rechargeable: yes.

4.3 SOFTWARE USED

4.3.1 Arduino IDE

CHAPTER 05

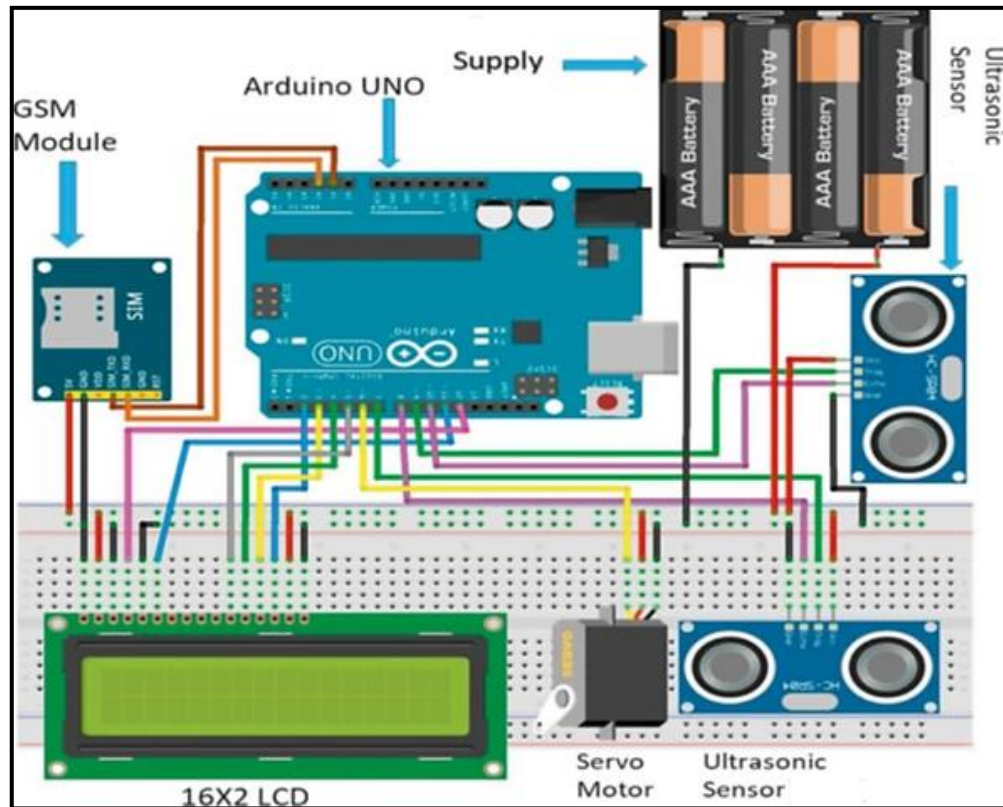# WORKING PRINCIPLE

5.1 CIRCUIT DIAGRAM

Fig 5.1: Circuit Diagram.

In our proposed system, it contains two bins for the storage of wastes. Initially, the waste has to be placed in the main container / Bin the waste is detected by the moisture sensor which is placed below the main bin above the lid. The type of wate is detected by the moisture sensor and sends the data to the main unit. The moisture sensor senses the waste either it is dry or wet waste by using the Arduino UNO of the medium which is a function of water content. Then it displays in the LCD to the user whether this detected waste is dry or wet based on a previously set threshold value. The dry and wet waste bin which is placed below the main bin which rotates with the help of DC motor based upon the detected by the moisture sensors. The bin / container return to its origin position after the waste get dumped the ultrasonic sensors placed upon the two containers which is detect the garbage level and send the information to the GSM module which transfer the notification of bin level in the form of text message to the registered phone.

CHAPTER 06

RESULTS

6.1 OUTCOME OF THE PROJECT
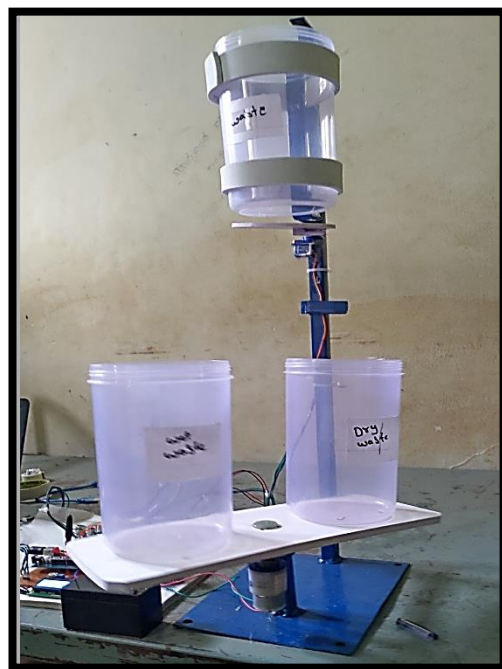

Fig 6.1: Empty Bins

Fig 6.2: Dry Waste is detected
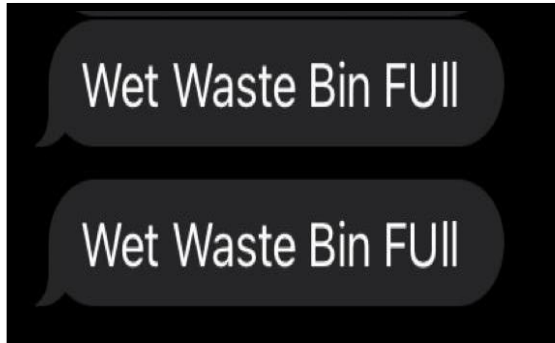
Fig 6.3: Wet Waste is detected

Fig 6.4: SMS to CMC through GSM module

The proposed system can be implemented everywhere in the cities and also in urban areas to which pollution free and creates an environment friendly atmosphere which helps to lead healthy, hazardous free life. It saves the life of the people without causing hazards to life by avoiding the overflow of bins.

CHAPTER 07

ADVANTAGES & APPLICATIONS

7.1 ADVANTAGES

- This system keeps our surroundings free, clean, and green from the odour of trashes supports good environmental conditions, and keeps towns more beautiful.
- It also helps to reduce the requirement of manpower to manage the waste collection process.
- Due to direct message transformation between smart segregation system and municipal department the traffic flow on the road reduces.
- The automatic waste segregation process also helps to reduce the health issues and work stress of workers who manually segregate the wastes.
- It also plays a major role in the reduction of environmental pollution.

7.2 APPLICATIONS

This can be implemented in the various places such as,

- Hotels & Restaurants.
- Government offices.
- Corporates offices.
- Residential areas.

CHAPTER 08

CONCLUSION & FUTURE SCOPE

8.1 CONCLUSION:

Waste management are all those activities required to manage waste from its production to its disposal. In this project the waste which will be collected on the platform will be segregated according to their moisture levels. As we put the waste on the platform the moisture sensor will sense its moisture and the waste will be segregated into their respective bins which are placed below (Dry waste bin and Wet waste bin). As the name suggests "Automatic Waste Segregation" it will segregate waste into 2 major classes which are Dry and Wet waste.

8.2 FUTURE SCOPE:

- Solar panels can be used as power supply.
- Soil pollution can be reduced
- By implementing we can avoid the Bacteria, Hazards,
- By segregating the waste, we can easily identify the wet and dry materials hence it helps to recycling.
- Inlet section can be incorporated with a crusher mechanism to reduce the size of incoming waste.
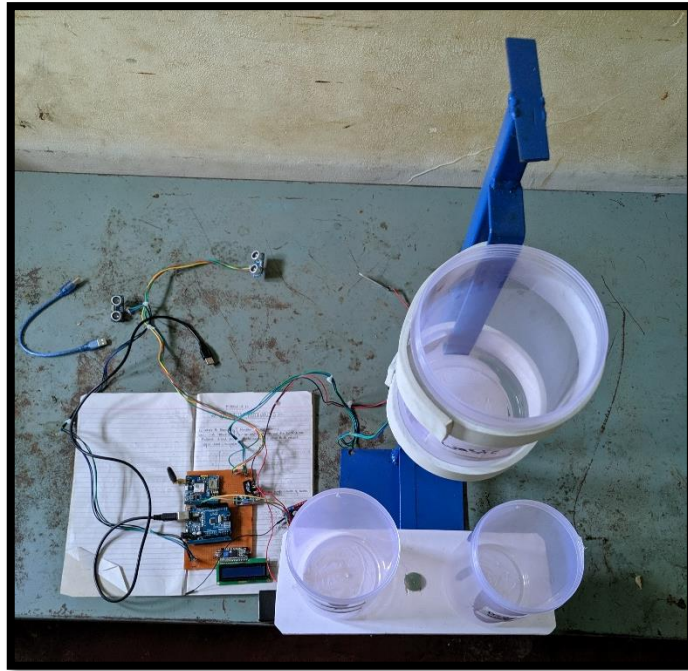
PHOTO GALLERY

Fig 9.1: Top View

Fig 9.2: Front view

REFERENCE

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